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ABSTRACT

Computer simulations of agricultural finance and management may be helpful to students preparing for agricultural careers. Simulations would provide problem definition and problem solving in realistic interactions with complex and ambiguous situations similar to those encountered in farming. The paper describes a major financial problem for farmers, explores the implications of that problem for students, and outlines a computer-based simulation model which would give students experience in dealing with the problem. Data sources for simulations, potentials of interactive exercises among students, and advantages of using real data with existing ambiguities are described. The board game "AGRICULTURE" is discussed as a prototype for simulation. (LFL)

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COMPUTER SIMULATION OF FACTORS AFFECTING RURAL EDUCATION

by

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Schools in the United States have experienced severe criticism during recent years because of perceived failure to prepare students adequately for the requirements they will encounter as adults living in a complex technological society (Karp, 1985). Criticisms range from inadequate preparation in basic skills to concerns about students' abilities to meet the scientific and technological requirements of training programs for various careers (Sizer, 1985). In some areas, the latter kinds of concerns are exacerbated by doubts about specific patterns of preparation needed for success in certain careers. Agriculture is one such career area, for it is becoming increasingly evident that difficulties being experienced by farmers require preparation beyond that provided by traditional vocational agriculture programs. Welding, mechanics, and livestock or crop management skills may continue to be necessary components of those programs, but it seems clear that they will not be sufficient. The size of investments and the complexity of management problems involved in maintaining economically viable units in modern agriculture clearly require preparation in finance and business management. Further, rapidly-changing conditions imply that training in those areas must keep abreast of developments as they occur, and that complex interactions of changing variables must be encountered in realistic problem-solving experiences rather than isolated academic sequences (Sternberg, 1985). All of these features point toward computer simulations as ideal means for the preparation of prospective farmers.

This paper will describe a major source of financial difficulty for farmers, explore the implications of that problem situation with regard to preparing students for agricultural careers, and outline a computer-based simulation model for conducting such preparation. Underlying assumptions are similar to those of Sternberg (1985) and Schon (1984), in that problem definition and problem-solving in realistic interactions with complex ambiguous situations are regarded as essential characteristics of educational programs designed to meet future needs.

Agriculture provides convenient examples of hazards inherent in failing to utilize sufficiently broad perspectives when dealing with changing conditions and emerging problems. The widespread financial crisis in agriculture has received much publicity during recent months, both in the popular press and in journals oriented toward technical aspects of the problem. While there is general agreement that low farm commodity prices combined with rapidly escalating costs of

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supplies and machinery to produce the basic structure of the problem, there are other aspects of the situation which are especially relevant to the present analysis. One was a fundamental shift in relationships between key variables which caught many farmers by surprise. That shift involved the changing impact of debt/asset ratios caused by the rapid slowing of inflation during the past four years, along with related changes in lending policies by governmental agencies and financial institutions.

Assuming appropriate management practices and favorable weather conditions, profit margins in agriculture, as in other business enterprises, are determined by one's ability to maintain positive relationships between prices received for products and costs of production. Since farmers generally are unable to set prices for their products, their profits have been closely tied to improved efficiency per unit of production and to expansion of total volume. Functionally, for family farming operations, these principles have translated into attempts to keep fuel and labor costs per acre down while increasing yields per acre and total acres farmed. Larger and more efficient machines which could cover more acres per operator hour at low cost per acre have been viewed by most farmers for many years as prime factors in maintaining profit margins. That view was promoted vigorously by machine dealers, and received impetus from the escalating cost and threatened shortages of fuel during the time of the Arab oil embargo. It received additional support from several years of especially rapid inflation during the 1970's when prices of machinery increased so rapidly that used machines frequently could be sold or traded at full original prices after several years of service. Some farmers viewed this situation as opportunity to obtain free use of valuable assets, downplaying the importance of overhead involved in huge machinery inventories.

Along with their machinery, many of these individuals also aquired additional land in order to increase volume. That strategy worked well during inflationary times, for land prices escalated at rates which increased assets faster than the debts incurred through the additional purchases. Interest payments became very large for many farmers, but so long as the banks used an asset basis for lending, they were able to increase both net worth and the production bases of their operations through heavy borrowing.

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The situation changed dramatically when inflation slowed and banks switched from asset to cash-flow bases for lending. Suddenly large interest payments descended with frightening impact on already strained cash-flow positions. Land prices began to decline as forced sales created more anxious sellers than eager buyers, and prices obtained for used machinery tumbled for the same reasons. Many farmers remembered too late that investment businesses contribute to real income only when assets are sold for profit - not when they appear on the books - and production remained their only source of income so long as they retained their expensive land and machinery.

This situation reveals several of the factors which necessitate changes in preparation programs for agricultural careers. First, it shows that traditional skills such as welding or mechanics are not sufficient to maintain profitability in the face of massive financial hemorrhages such as these which can be produced by interest charges, depreciation on large inventories, or declining commodity prices. Second, it reveals the need for foresight, especially in the early recognition of emerging problems or re-definition of problems in the light of changing conditions. Finally, it demonstrates the importance of thorough understanding of the many variables which can influence success, especially in areas such as finance and management, and of the complexity of their interactions. Combined, these factors clearly indicate that new realities must be faced if prospective farmers are to be prepared for the challenges which they will encounter. Schools in rural areas can contribute significantly to the health of their communities by preparing to meet these emerging needs.

Fortunately, computers lend themselves very well to possible solutions to several aspects of this problem situation. They offer the potential for individualized instruction in various contributory skills, which can be very important in those cases where small, isolated rural schools lack resources necessary to offer classes. In the simulation mode, they can provide exceptionally realistic experiences in problem solving with real data, especially in problem areas where data bases are routinely up-dated, as they are in agriculture by various agencies. Computers offer the ideal medium for trying out various alternative methods for dealing with problems, since they can provide almost immediate feedback about relative advantages and disadvantages of each solution (Papert, 1980). Finally, they have the important

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potential for linking into networks for interactive exercises among learners at different sites, thus enabling competitions among teams, access to central data bases, and instruction of scattered learners by a teacher located at a central site.

Data bearing on many of the management and financial issues which farmers face are readily available from a variety of government sources and financial institutions. These include supply and demand estimates for various commodities, futures prices, planting intentions for different crops, present and projected interest rates, land and machinery prices, weather data, insurance rates, results from test plots involving fertilization experiments and new seed varieties, energy costs, production records for different crops under various weather and soil conditions, and many othger variables involved in farmers' decisions. Many of these are available on a monthly basis from various governmental agencies or official publications, while others which vary by locality can be obtained from county offices, local agencies (e.g., crop insurance rates), agricultural colleges, and commercial sources such as machinery dealers. While the assembly and updating of a centralized data base would be a significant task, the fact that it could be utilized by several schools in a given region would justify the effort.

More difficult would be the constructs required to link the variables in valid relationships, since the value of the simulation would depend heavily on such validity. However, once again, many of the linkages have been empirically established (e.g., effects of fertilizer and water on crop production), while others could be based upon trend analyses (interest rates, land prices, etc.). The fact that some of the linkages are unknown or vary so rapidly that relationships in the programs may be somewhat arbitrary is not a fatal flaw, since one of the important purposes of the exercises is to promote student awareness and exploration of such problems in the real-world interactions of these variables. Further, existing versions of simulations in the area of agriculture seem even more removed from current realities in the real world than this program would become if it derived its algorithms from best approximations.

Approximations were worked out some years ago by the author on the basis of case studies of farmers' experiences in a particular locality, for purposes of structuring a board game ("AGRICULTURE") which he developed. Limitations inherent in the board-game format

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obviously place greater constraints on the precision and complexity of interactions among variables than does a computer-based simulation, and variables would exist in different relationships at present than when the game was developed, but the basic concepts could be adapted. A brief description of characteristics might help to illuminate those concept.

Probably the popular game of Monopoly would provide the most convenient conceptual parallels, in that players moved around the board on the basis of throws of the dice, and encountered various opportunities to purchase certain investment properties on the basis of these moves. However, unlike Monopoly, players did not gain exclusive ownership of any particular kind of property by being the first to purchase it. Also, in addition to the financial resources with which they began the game, players could borrow money for their purchases at realistic rates of interest, which varied according to their debt. Spins of a "WEATHER DIAL" determined weather conditions for a season, with relative probabilities of various possible weather conditions based on records for the region reflected in the relative size of the sections on the dial. Insurance on crops or other property could be purchased at realistic rates to protect against the possibility of hail, fire, or other hazards for which risk was assessable. Randomly-occuring risks and benefits were encountered on the basis of draws from decks of cards dealing with different categories of events, with drawing opportunites based on certain throws of the dice.

The most difficult aspect of the game to manage in the board format was the record-keeping task which developed as each player accumulated a set of properties and began to experience the gains and losses which accrued from their choices in interaction with the probabilities of weather conditions, price changes, interest rates, hazards, etc. Obviously, the capabilities of the computer for managing large amounts of data can ease that problem considerably, and can add significantly to the realism with which probabilities can be used to duplicate actual conditions (for example, relative costs and benefits of such decisions as purchasing new equipment vs. repairing older equipment). Tax considerations and interest charges can be worked into these considerations more realistically as well with the capabilities of the computer as a resource.

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Potential would seem promising for a hybrid version of the game rather than a pure version of either board game or computer simulation, since the hybrid would encorporate advantages of both approaches. The flow of events is maintained by the use of the board, and the occurrence of unpredictable hazards or benefits can add excitement in board format. The computer, on the other hand, can be programmed to deal with those aspects which are laborious or too complex to maintain as part of the board game, with outputs such as balance sheets for each player as feedback regarding the relative success of various choices and also as criteria for determining game outcomes.

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REFERENCES

1. Karp, W. Why Johnny Can't Think: The Politics of Bad Schooling. Harpers, 1985, 270, 69-73.

2. Schon, D.A. Toward a New Epistemology of Practice: A Response to the Crisis of Professional Knowledge. Global Leaning Symposium: Ontario Institute for Studies in Education, 1984.

3. Sizer, T. Horace's Compromise: The Dilemma of the American High School. Boston: Houghton Mifflin, 1984.

4. Sternberg, R. Beyond Intelligence: A Triarchic Theory of Human Intelligence. New York: Cambridge University Press, 1985.

5. Papert, S. Mindstorms: Children, Computers, and Powerful Ideas. New York: Basic Books, 1980.